IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

In re the Application of

Inventor	**:**	**Rohit Garg et al.**
Application No.	**:**	**10/578,632**
Filed	**:**	**May 9, 2006**
For	**:**	**ULTRASONIC IMAGING SYSTEM AND METHOD FOR SIMULTANEOUS DISPLAY OF BLOOD FLOW AND PERFUSION PARAMETERS**

APPEAL BRIEF

On Appeal from Group Art Unit 3737
Examiner Rochelle D Reardon

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I. REAL PARTY IN INTEREST

The real party in interest is Koninklijke Philips Electronics N.V., Eindhoven, The Netherlands by virtue of an assignment recorded May 9, 2006 at reel 017896, frame 0587.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

This application was originally filed with Claims 1-19. During prosecution Claims 2 and 12 were canceled. Claims 1, 3-11 and 13-19 stand finally rejected by an Office Action mailed January 26, 2010. Claims 1, 3-11 and 13-19 are the subject of this appeal.

IV. STATUS OF AMENDMENTS

An amendment filed after the final Office Action was admitted by the Examiner in an Advisory Action mailed April 8, 2010. A notice of appeal was timely filed on April 19, 2010.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

In diagnostic ultrasonic imaging a clinician is trying to discern specific characteristics of a region of interest in the body. Since diagnostic ultrasound can produce anatomically precise images of a region in the body, the diagnosis is greatly aided by enabling the clinician to correlate specific characteristics with the anatomy to which they relate. The present invention provides a unique way to visually present correlated information of tissue perfusion, the rate and amount of blood flowing in the tiny microvasculature of tissue. The present invention shows perfusion in the best way for tiny vessels, which is by use of harmonic contrast enhancement of the blood flow. An implementation of the invention produces two images of the region of interest, one of the tissue structure and the other of harmonic contrast enhanced perfusion. The conventional way to display two images is a side-by-side presentation. But this requires the clinician to look back and forth between the two images, trying to do the anatomical correlation mentally. The present invention solves two problems, one of which is correlating for the clinician a parametric image to the tissue and blood flow to which the parameters of the image relate. The other problem solved is doing this in an anatomically visual manner, as the two images are of the same anatomy. Simply overlaying the two images would cover the underlying

image. These problems manifest themselves with both 2D and 3D anatomical comparisons. As shown in Figs. 15A-15E of the present application, by enabling the clinician to vary the opacity of one or both of the anatomically registered images, the clinician can fade back and forth between an image of the tissue and blood flow and an image of the parameter in registration therewith, or a combination of the two. The clinician can thus see a defect such as a blood flow anomaly in the perfusion image and immediately fade to the corresponding tissue to quickly identify and confirm an infarcted region of the myocardium, for instance.

Independent Claims 1 and 10 are supported by the drawings and specification as seen by reference numerals (#) of the drawings and the specification text (pg., ln) as follows:

1. A method of simultaneously displaying a two or three dimensional parametric perfusion image and an anatomical structural image of the region of interest corresponding to the parametric perfusion image on an ultrasonic image display, comprising:

acquiring an anatomical structural image of a region of interest of a subject comprising tissue containing blood flow{Fig.15a #92; pg. 8, ln 26 to pg. 9, ln 17; pg. 11 ln 4-15};

acquiring harmonic signal components from a harmonic contrast agent in the region of interest of the subject {Fig. 3 #70; pg 7, ln 6-20};

processing harmonic signal components of corresponding locations in a sequence of images to form a parametric image of a perfusion characteristic of the tissue of the region of interest {Figs. 9a & 9b; pg. 9, ln 18 to pg. 10, ln 18}; and

displaying the parametric perfusion image in anatomical registration with the anatomical structural image, wherein the relative opacity of the registered parametric image and anatomical structural image is variable over a range of relative opacities {Fig. 15a-15e; pg. 11, ln 4 to pg. 12, ln 12}.

10. A diagnostic imaging system for displaying a two or three dimensional parametric perfusion image in anatomical registration with a two or three dimensional anatomical structural image of a region of interest of a subject comprising:

an image processor {#36, #154; pg. 13, ln 9-10} which produces anatomical structural images of a region of interest of a subject comprising tissue containing blood flow;

a contrast signal processor {#138; pg. 12 ln 14 to pg. 13, ln 6} which produces harmonic signals received from a harmonic contrast agent in the region of interest;

a parametric perfusion image processor {#156; pg. 12 ln 14 to pg. 13, ln 8} responsive to harmonic signals from corresponding locations in a sequence of images which produces a parametric perfusion image of the tissue of the region of interest of the subject;

a display {#50, #52; pg. 13, ln 9 -17} coupled to the anatomical structural image processor and the parametric perfusion image processor which displays an anatomical structural image and a corresponding parametric perfusion image of the same region in anatomical registration;

a display processor {#154, #148; pg. 13, ln 11-14} coupled to the display which acts to set the relative opacity of the registered anatomical structural image and parametric perfusion image; and

a user control {#160; pg 13, ln 11-14}, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical structural image and parametric perfusion image.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether Claims 1, 3-9, 11 and 14-18 are objectionable due to informalities

B. Whether Claims 3, 4, 10, 11, and 13-19 were correctly rejected under 35 U.S.C. §112, second paragraph, as being indefinite

C. Whether Claims 1, 3-11 and 13-19 were correctly rejected under 35 U.S.C. §103(a) as being unpatentable over US Pat. 5,720,291 (Schwartz) in view of US Pat. 6,171,246 (Averkiou et al.)

VII. ARGUMENT

A. Whether Claims 1, 3-9, 11 and 14-18 are objectionable due to informalities

Claim 1 was objected to be cause "the region of interest" recited in line 3 of the preamble lacks antecedent basis. It is respectfully submitted that this phrase, when read in context, clearly refers to the region of interest corresponding to the parametric perfusion image. However, the applicants would be pleased to change the word "the" to

"an" or make any similar change suggested by the Examiner to provide antecedent language.

Claims 11 and 14-18 were objected to as failing to set forth further structural limitation. It is respectfully noted that Claim 11 provides further limitation of the parametric perfusion image produced by the parametric perfusion image processor of Claim 10. Claims 14-16 and 18 provide further limitation of the user control of Claim 10. Claim 17 provides further limitation of the display of Claim 10. It is therefore respectfully submitted that these dependent claims provide further limitations of the structure first described in Claim 10.

B. Whether Claims 3, 4, 10, 11, and 13-19 were correctly rejected under 35 U.S.C. §112, second paragraph, as being indefinite

Claim 3 was rejected for lack of antecedent basis for the step of "acquiring a parametric image." Claim 3 was amended in the amendment after final action to cure this problem and now refers to the second acquiring step and the processing step of Claim 1. Claim 4 was rejected as being unclear whether the contrast agent in Claim 4 is the contrast agent referred to in Claim 1. It is respectfully submitted that one reading the two claims would read it as such. Applicants would be pleased to respond to the Examiner's suggestions to provide any needed further clarification. Claim 10 was rejected because "the source" in line 12 has no antecedent basis. This element was deleted and the reference

changed to the anatomical structural image processor in the amendment after final action. Applicants thank the Examiner for entering this amendment so that these changes could be made.

The other claims of this §112 rejection inherited their defects by reason of their dependency. It is respectfully submitted that the changes and explanation given above address the rejection of all of the claims of this rejection.

C. Whether Claims 1, 3-11 and 13-19 were correctly rejected under 35 U.S.C. §103(a) as being unpatentable over US Pat. 5,720,291 (Schwartz) in view of US Pat. 6,171,246 (Averkiou et al.)

The Examiner's presumption that the subject matter of the claims has been commonly owned at all relevant times is correct.

An important aspect of the present invention is that the parametric perfusion image and the anatomical structural image are both of the same region of interest. They are different images of the same region of the body. In the example of 2D images shown in Figs. 15a-15e of the application, both images are of the same image plane. Since both images are of the same region of interest, the same plane in 2D imaging, conventional practice is to display them side-by-side. If they were displayed in registration, one would only see the top overlay because they are both of the same region.

Schwartz is dealing with a different problem. Schwartz is concerned with a problem particular to 3D imaging; he is unconcerned with 2D imaging. Schwartz is trying enable the major blood vessels to be seen in a 3D block of tissue. Normally, as would be expected if the block of tissue were physically excised from the body and viewed, the blood flow inside the block of tissue cannot be seen because of the surrounding tissue. Even though the blood vessels and the tissue are in different regions, different anatomical locations, the vessel locations cannot be seen through the surrounding tissue. Schwartz solves this with opacity control that enables the tissue to be viewed translucently. The translucency of the surrounding tissue retains the anatomical context of the tissue while enabling the clinician to see through the surrounding tissue and see the blood vessels inside and their flow in their own separate anatomical locations. Averkiou et al. take the same approach. They display contrast agent microbubble signals in combination with the structural display of the surrounding tissue. See Averkiou et al. at col. 2, lines 28-30. When Averkiou et al. consider a 3D implementation, they cite Schwartz for exactly what to do: a 3D display of bloodflow and its surrounding tissue, ostensibly with translucency of the surrounding tissue. See Averkiou et al. at col. 4, lines 52-56.

This is not the problem addressed and solved by the present invention. The instant problem is not one of seeing blood flow in one region through the tissue of the surrounding region. The two images, the perfusion image and the structural image, are two different images of the same region of interest, not one of one region and another of a different, surrounding region. There is no suggestion in either Schwartz or Averkiou et al. of what to do for images of the same region. The present inventors have provided a solution to this problem by displaying the two different images of the same region in anatomical registration. The clinician can view one image of the region or the other, or fade from one to the other with an opacity control, and at all times have the same impression of the anatomical correlation of the two images.

Claim 10, like Claim 1, calls for anatomical structural images of a region of interest and a parametric perfusion image of the same region of interest, the two being displayed in anatomical registration. The use of two images of the same region and how to deal with them is not shown or suggested in either Schwartz or Averkiou et al. For this reason it is respectfully submitted that the combination of Schwartz and Averkiou et al. cannot render Claims 1 and 10 and their dependent Claims 3-9, 11 and 13-19 unpatentable.

VIII. CONCLUSION

Based on the law and the facts, it is respectfully submitted that Claims 3, 4, 10, 11 and 13-19 are clear and definite, and that Claims 1, 3-11, and 13-19 are patentable over any combination of Schwartz and Averkiou et al. Accordingly, it is respectfully requested that this Honorable Board reverse the grounds of rejection of Claims 1, 3-11 and 13-19 of this application which were stated in the January 26, 2010 Office action being appealed.

Respectfully submitted,

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June 17, 2010

APPENDIX A: CLAIMS APPENDIX

The following Claims 1-19 are the claims involved in this appeal.

1. (previously presented) A method of simultaneously displaying a two or three dimensional parametric perfusion image and an anatomical structural image of the region of interest corresponding to the parametric perfusion image on an ultrasonic image display, comprising:

acquiring an anatomical structural image of a region of interest of a subject comprising tissue containing blood flow;

acquiring harmonic signal components from a harmonic contrast agent in the region of interest of the subject;

processing harmonic signal components of corresponding locations in a sequence of images to form a parametric image of a perfusion characteristic of the tissue of the region of interest; and

displaying the parametric perfusion image in anatomical registration with the anatomical structural image, wherein the relative opacity of the registered parametric image and anatomical structural image is variable over a range of relative opacities.

2. (canceled)

3. (previously presented) The method of claim 1, wherein acquiring harmonic signal components and processing harmonic signal components further comprise acquiring a parametric image of the blood flow perfusion of the tissue in the region of the body.

4. (original) The method of claim 3, further comprising directing a flow of contrast agent to the region of interest of the subject.

5. (previously presented) The method of claim 1, further comprising varying the relative opacity of the registered parametric image and anatomical structural image in a continuous manner.

6. (previously presented) The method of claim 1, further comprising varying the relative opacity of the registered parametric image and anatomical structural image in a stepwise manner.

7. (original) The method of claim 5, wherein varying the relative opacity further comprises varying the opacity within a range extending from an opaque anatomical image and a transparent parametric image; to an opaque anatomical image overlaid with an opaque parametric image; to a transparent anatomical image and an opaque parametric image.

8. (original) The method of claim 7, wherein varying the opacity within a range further comprises varying the opacity within a range which includes an opacity setting in which a translucent parametric image is shown in registration with a substantially opaque anatomical image.

9. (original) The method of claim 6, wherein varying the relative opacity further comprises varying the opacity within a range extending from an opaque anatomical image and a transparent parametric image; to an opaque anatomical image overlaid with an opaque parametric image; to a transparent anatomical image and an opaque parametric image.

10. (previously presented) A diagnostic imaging system for displaying a two or three dimensional parametric perfusion image in

anatomical registration with a two or three dimensional anatomical structural image of a region of interest of a subject comprising:

an image processor which produces anatomical structural images of a region of interest of a subject comprising tissue containing blood flow;

a contrast signal processor which produces harmonic signals received from a harmonic contrast agent in the region of interest;

a parametric perfusion image processor responsive to harmonic signals from corresponding locations in a sequence of images which produces a parametric perfusion image of the tissue of the region of interest of the subject;

a display coupled to the anatomical structural image processor and the parametric perfusion image processor which displays an anatomical structural image and a corresponding parametric perfusion image of the same region in anatomical registration;

a display processor coupled to the display which acts to set the relative opacity of the registered anatomical structural image and parametric perfusion image; and

a user control, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical structural image and parametric perfusion image.

11. (previously presented) The diagnostic imaging system of Claim 10, wherein the parametric perfusion image comprises a parametric image of a characteristic of the blood flow perfusion in the region of interest.

12. (canceled)

13. (previously presented) The diagnostic imaging system of Claim 10, wherein the display processor further comprises an opacity

processor which acts to set the relative opacity of the registered anatomical image and parametric perfusion image within a range varying from an opaque anatomical image and a transparent parametric perfusion image; to an opaque anatomical image overlaid with an opaque parametric perfusion image; to a transparent anatomical image and an opaque parametric perfusion image.

14. (previously presented) The diagnostic imaging system of claim 10 wherein the user control comprises a user control, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical image and parametric perfusion images within a continuous range of relative opacity settings.

15. (previously presented) The diagnostic imaging system of claim 10 wherein the user control comprises a user control, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical image and parametric perfusion images to one of a discrete number of relative opacity settings.

16. (previously presented) The diagnostic imaging system of claim 10 wherein the user control comprises a user control, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical image and parametric perfusion images to a setting in which the display displays a translucent parametric perfusion image in registration with a substantially opaque anatomical image.

17. (previously presented) The diagnostic imaging system of claim 10 wherein the display further comprises a display which displays in real time a anatomical image sequence and a corresponding parametric perfusion image sequence in anatomical registration.

18. (previously presented) The diagnostic imaging system of claim 10 wherein the user control comprises a user control, coupled to the display processor, by which a user can set the relative opacity of the registered anatomical image and parametric perfusion image to a setting in which the display displays a translucent anatomical image in registration with a substantially opaque parametric perfusion image.

19. (previously presented) The diagnostic imaging system of claim 10 wherein the user control further comprises a plurality of separate user controls by which a user can set the opacity of the parametric perfusion image and the opacity of the registered anatomical image.

APPENDIX B: EVIDENCE APPENDIX

None. No extrinsic evidence has been submitted in this case.

APPENDIX C: RELATED PROCEEDINGS APPENDIX

None. There are no related proceedings.